

## PATENT SPECIFICATION (11)

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## (54) LUMINOUS PANEL

(71) We, INTERNATIONAL VIBRATION ENGINEERING, a French Body Corporate of 29, route de Milly, 91820 Boutigny sur Essonne, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a luminous panel of a type having indications or inscriptions which have to be illuminated in order to be readable.

Luminous panels of this sort are known which are made, for example, of Plexiglass (Registered Trade Mark) and are intended to form instrument panels for aircraft which have to be visible both in the light and in the dark. Moreover, certain of these panels have to be illuminated in different colours, such as red, green, yellow or amber.

These known panels are formed by a plate of transparent synthetic material on the inside of which are placed small electric light bulbs. The plate is covered, generally on both its surfaces, with a layer of clear or diffusing colour, and then with an opaque layer, and a suitable engraving process, partially eliminating the opaque layer at the point of the inscriptions, allows these inscriptions to become visible due to the light diffused inside the panel.

When it is desired to obtain a particular colour of lighting, it is then necessary to apply a coloured varnish, either on the light bulbs or on the sides of its housing, in the transparent panel. As a variation it is possible equally to use lamps the glass of which has been tinted by pigments introduced into the mass.

These known panels have a certain number of disadvantages. First of all, the heat emitted by the incandescent lighting is not insignificant and brings about deterioration of the colour varnish. Moreover due to the fact that the greatest part of the electric power used by the lighting is transformed into heat it is necessary to limit the number of lamps on each unit of the surface of the synthetic panel if there is to be no risk of a

premature deterioration of this support.

Also, in aircraft, the light given out by the instrument panels is reflected onto the transparent surfaces of the cockpit and that can be an annoyance for the pilots, particularly when they use night binoculars or other photomultiplying apparatus.

Finally, the low luminous output of the incandescent lighting can necessitate relatively powerful electric sources in order to obtain a good quality panel, which can be a disadvantage if the available power is limited, as in the case of panels on aircraft.

The present invention proposes to remedy these disadvantages and to provide a luminous panel having an increased quality and longevity, less use of electricity and constant illumination, particularly from the point of view of colour.

Moreover, the invention proposes to provide a panel which has an increased resistance to shocks and vibrations.

According to the present invention a luminous panel comprises a plate of synthetic transparent material, covered with an opaque layer having on one of its surfaces light transmitting inscriptions to be illuminated, the said plate receiving in its interior one or more light sources in the form of electroluminescent diodes placed in housings formed in the plate and connected to an electric feed circuit.

In one construction the electro-luminescent diodes are placed inside the housings made in the thickness of the panel and are separated from the side of each housing by an empty space.

However, in another form of construction, the electroluminescent diodes are embedded in a transparent material in an optical continuity with the material of the synthetic plate and in this case at the time of manufacture, the diodes can advantageously be put in place in the housings or pockets of the plate, embedding them inside a settable material.

It has been shown that the panels according to the invention have a remarkable resistance to shocks and vibrations which permits their use in conditions where this was not previously possible.

Moreover, it has been shown that in time a remarkable stability of illumination was obtained as much from the point of view of the quality of the colour as from that of its intensity.

Also, the invention allows the placing in weak panel surfaces of a large number of light sources without risking secondary effects concerning the colour or the intensity of illumination or the quality of the constituent materials.

In particular when one uses, for example in an aircraft, apparatus for nocturnal observation, such as binoculars with a photomultiplying effect, the reflections of the panels in the cockpits, which could disturb observation, can easily be eliminated by putting onto the photomultiplying apparatus or the night binoculars a specific radiation filter for the diodes used. Thus, in the case of radiation from green diodes, filters can be used which prevent the passage of the band going from green to infra-red.

Other advantages and characteristics of the invention will become apparent from reading the following description made as a non-limitative example and referring to the attached drawings in which:

Figure 1 is a partial section view of a panel according to one form of construction of the invention.

Figure 2 is a partial section view of a panel according to another form of construction of the invention.

Referring to Fig. 1, there is shown in cross section a part of a panel comprising a thick plate 1, e.g. in the order of 4 to 10mm, in Plexiglass (Registered Trade Mark), 1, provided with a diffusing layer in epoxy paint 2, on its upper and lower surfaces, each of these layers being itself covered with a layer of opaque varnish below at 3 and above at 4. The upper layer is provided in places, by a process of a type known in itself, with clear spaces 5, being part of the suitable inscriptions designed to be illuminated.

From place to place cylindrical pockets with a semi-spherical bottom 6 are made in the panel from the bottom surface. The position of these pockets is determined by the requirements of the illumination. On the inside of a pocket 6, an electroluminescent diode 7 is placed, e.g. of the type sold under the reference 5082-4684 by Hewlett-Packard, providing a red illumination. The two conductors 8 of the diode are linked to a printed feed circuit of suitable kind (not shown).

In accordance with the invention, the internal side of the pocket 6 does not comprise any coloured covering, the coloured radiation of the diode being used directly. It is understood that the radiation of the diode should be capable of directly illuminating the part of the inscription 5

represented on the drawing, but this radiation also travels transversely in the panel to contribute with other luminous diodes to the illumination of other distant inscriptions.

However, it is possible, if desired, to use diodes of another type having a more directed radiation, e.g. on the level of the upper surface to illuminate solely one area of small diameter which permits the use of inscriptions in different colours very close to one another, something which is always difficult to bring about, without using either a filter or a hood.

Referring to Fig. 2, there is shown a variation of the invention in which the diode 7 is also introduced into a pocket analogous to pocket 6 but the electroluminescent diode is then embedded with the aid of a polymerisable substance of the same nature as the synthetic plate 1. After polymerisation, the part situated between the radiating area of the diode and the synthetic material is practically homogeneous, and thus further increases the efficacy of the diode. Further, such an installation is particularly compact and resists shocks and vibrations particularly well.

Experiments also show that longevity is increased further as the heat given off by the diodes is negligible.

Moreover, when the panels according to the invention are used in an aircraft all effect of reflections can be avoided in night binoculars, such as those sold under the trade mark TRT or ITT, by placing in the binoculars a filter preventing the passage of the specific radiation from the diodes used.

#### WHAT WE CLAIM IS:—

1. Luminous panel comprising a plate of 105 synthetic transparent material, covered with an opaque layer having on one of its surfaces light transmitting inscriptions to be illuminated, the said plate receiving in its interior one or more light sources in the form of 110 electroluminescent diodes placed in housings formed in the plate and connected to an electric feed circuit.

2. Luminous panel as claimed in claim 1, in which the electroluminescent diodes are 115 placed inside the housings made in the thickness of the panel and are separated from the side of each housing by an empty space.

3. Luminous panel as claimed in claim 1 in which the electroluminescent diodes are 120 embedded in a transparent material in optical continuity with the material of the synthetic plate.

4. Luminous panel as claimed in any one of the claims 1 to 3, in which each surface of 125 the plate is covered with a clear diffusing layer topped by the opaque layer.

5. Luminous panel substantially as described herein with reference to and as shown in the accompanying drawings. 130

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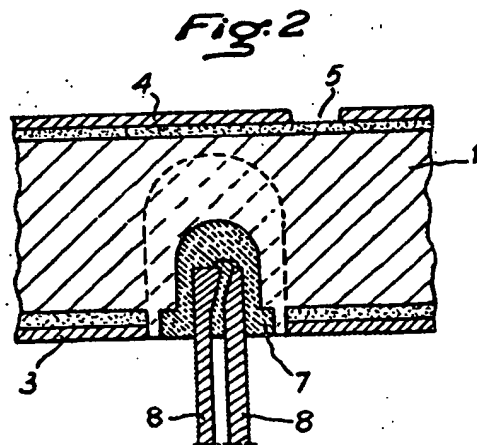
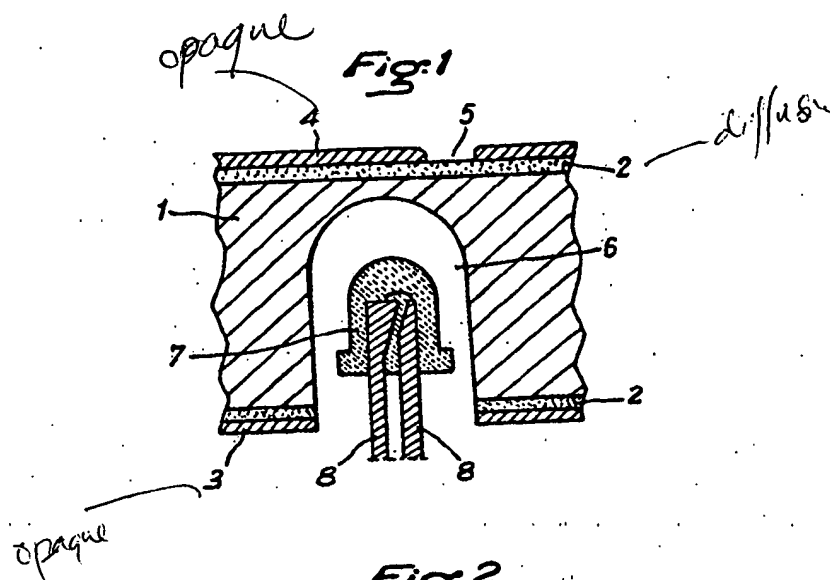
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